EU-MORE

EUropean MOtor
REnovation initiative

D4.5

Stock Model Support Documents Interactive Presentation

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About this document

The aim of this document is to provide a comprehensive understanding of the electric motor model developed for Task 4.2 as part of the EU-MORE project. This interactive presentation aims to facilitate the accessibility and usage of the policy impact assessment tool.

The document is structured into four main chapters:

- **Genesis** provides insight into the motivation and requirements behind the development of the model, elucidating its evolution and functionality.
- **Exploration** serves as a guide to get started with and how to use the tool, outlining the calculation of policy impacts.
- **Application** presents theoretical and practical country-specific case studies.
- **Reflection** discusses prerequisites and limitations of the model and provides an outlook.

Further materials can be found on the EU-MORE project website, including

- Deliverable D4.2 → EU-MORE Motor Model (EU-M³)
- Deliverable D4.3 → report on policy impacts
- Tutorial videos explaining the use and application of the model (as part of D4.5)

EU-MORE

EU-MORE is an acronym for EUropean MOtor REnovation initiative. This LIFE-Project aims to speed up replacement of old, inefficient electric motors in industry and the service sector. Electric motors tend to stay in service for 30 to 40 years, which is much longer than generally assumed. With swift action, this replacement rate could be improved. In the EU, replacing old motors faster would free up additional energy savings, on top of the savings potential of existing regulations, with all the associated benefits.

Project partners

Authors of this document

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Antoine Durand (Fraunhofer ISI)

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How to navigate

On the "Contents" slide, click on the icons or the subchapter text to jump to the respective chapter/subchapter

The objects in the footer are navigation elements, for moving to the "Contents" or between slides

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How to navigate

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This review, supported by literature studies, expert interviews, and assessments, details the characteristics, impacts, and lesso
leading countries in policy implementation and recommends more targeted motor replacement policies for energy savings and eco

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behavioral changes. However, their impact is harder to quantify.

See more information the three policies Subsidy Scheme, Tax Incentive in combination with Voluntary Agreements and Information Campaigns and Capacity Building on the next slide.

The EU-M^3 model requires policies to be translated into model inputs to assess the impacts of policies on EU or Member States level in motor system improvements. Financial policies like subsidy schemes and tax incentives are most relevant for estimating their impact, with both providing a certain amount of money to the company. The difference lies in the delivery of the
rough tax reductions for tax incentives. However, non-financial initiatives like informational campaigns, although challenging to forecast,
changes. Their impact is not calculated directly in the model, but cost-effectiveness ratios from existing programmes are used to provide
to financial ones.

Symbols in the top right corner bring you back to the start of the respective chapter.

For additional information, links to other reports from the EU-MORE project are sometimes provided.

Link to D2.2 Review of past and existing policies for the acceleration of electric motor renovation
Faassen, E.; Eichhammer, W.; Sangiorgio, I. (2024)

Link to D4.3 Policy impact analysis
Barkhausen, R.; Durand, A.; Ntaras, N.; Eichhammer, W. (2024)

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This user manual was created using the offline Excel file of the EU-MORE Motor Model (version 1.3). Click on the arrows in the navigation area to explore the tool.

Dashboard

On the dashboard the user sees information on the policies and further explanation on how to use the tool.

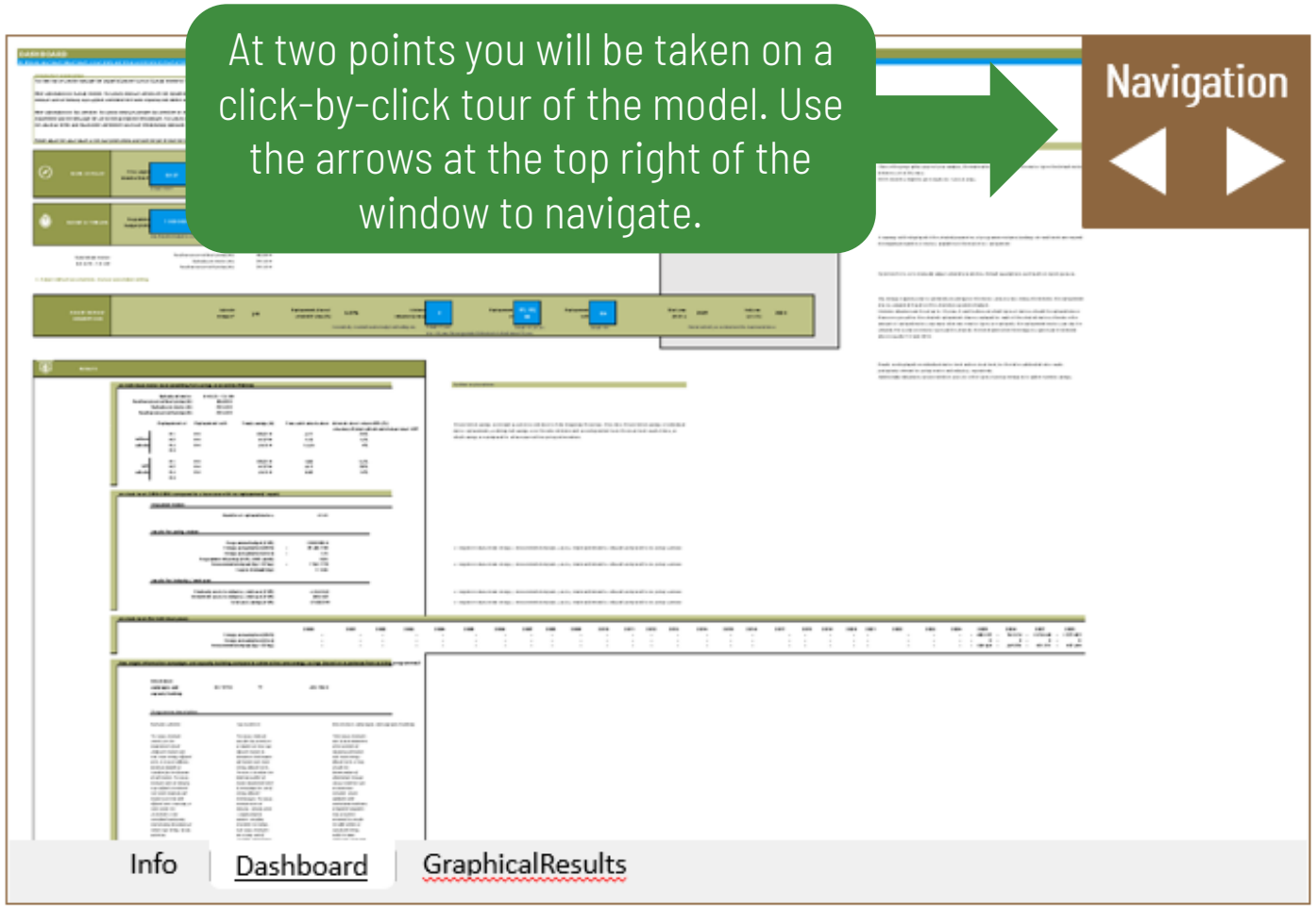

Figure: Click by click tour through the Excel file

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Contents

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EU-MORE

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1. Genesis

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1.1 Motivation & scope

The EU-M³ tool was developed with the primary objective of analyzing the impact of existing and new policies on electric motor replacement. The motivation behind the creation of this tool is to enable stakeholders, particularly policy makers, to comprehend the far-reaching implications of motor policy decisions and to equip them with a platform to conduct their analyses.

The requirements and delimitations of the tool are largely informed by the scope of Task 4.2 of the EU-MORE project, as well as preceding tasks. These tasks include the electric motor market analysis (T2.1), the assessment of end-of-life practices (T2.4), motor system efficiency trends (T4.1), the review of past and existing policy options (T2.2), and the design of new policies (T2.3).

The EU-M³ tool is applicable to the EU-27 market for industrial electric motors, with data on motor sales by technology, power range, and efficiency class. To accommodate the diverse range of motor types, the tool divides them into six efficiency classes (IE0 to IE5) and five power ranges (0.75-7.5 kW to >375 kW). Efficiency classes IE0 to IE4 represent squirrel cage induction motors (SCIM) while IE5 motors represent synchronous reluctance motors (SynRM). However, the tool currently does not include the use of Variable Speed Drives (VSDs) due to a lack of reliable data on their effects.

The quality of the model depends on the accuracy of underlying data. The EU-MORE motor market analysis filled gaps in data, providing an estimate of the installed base of motors and their electricity consumption. This data serves as the basis for potential savings calculations linked to policy recommendations.

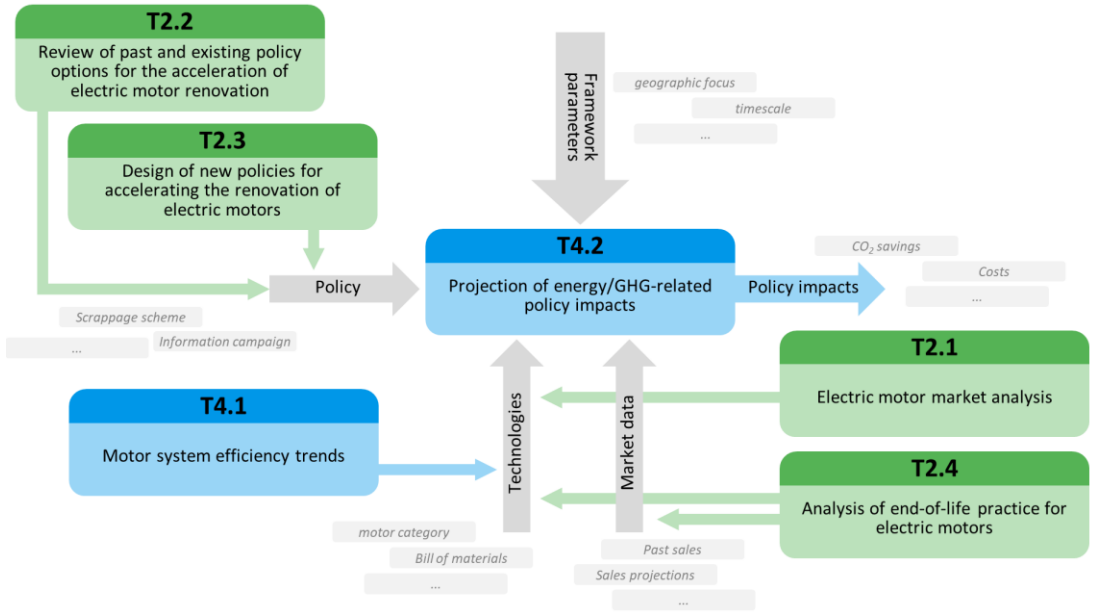

Figure: Overview of Task 4.2 (stock model development) inputs and outputs

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1.2 Covered policies (1/2)

The policies for the EU-M³ tool are primarily chosen based on the review of past policies (D2.2), which includes a comprehensive analysis of past and current electric motor policies in the EU. This review, supported by literature studies, expert interviews, and assessments, details the characteristics, impacts, and lessons learned from each measure. The report also identifies leading countries in policy implementation and recommends more targeted motor replacement policies for energy savings and economic growth.

The selected policies for the EU-M³ tool are mainly financial ones, encouraging the replacement of old motors with more efficient ones. Additionally, non-financial policies can also influence behavioral changes. However, their impact is harder to quantify.

See more information the three policies Subsidy Scheme, Tax Incentive in combination with Voluntary Agreements and Information Campaigns and Capacity Building on the next slide.

The EU-M³ model requires policies to be translated into model inputs to assess the impacts of policies on EU or Member States level in motor system improvements. Financial policies like subsidy schemes and tax incentives are most relevant for estimating their impact, with both providing a certain amount of money to the company. The difference lies in the delivery of the money, direct for subsidy schemes and indirect through tax reductions for tax incentives. However, non-financial initiatives like informational campaigns, although challenging to forecast, can enhance other policies or instigate behavioural changes. Their impact is not calculated directly in the model, but cost-effectiveness ratios from existing programmes are used to provide insights into their potential effectiveness compared to financial ones.

Link to D2.2 Review of past and existing policies for the acceleration of electric motor renovation
Faassen, E.; Eichhammer, W.; Sangiorgio, I. (2024)

Link to D4.3 Policy impact analysis
Barkhausen, R.; Durand, A.; Ntaras, N.; Eichhammer, W. (2024)

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1.2 Covered policies (1/2)

Subsidy Scheme

This financial policy provides incentives for replacing old, inefficient motors with new, energy-efficient ones, particularly targeting old motor systems and high electricity consumers. It offers a way to address high upfront investment costs when replacing old motors, making energy efficiency investment more economically attractive. Subsidy schemes are especially useful for mitigating risks faced by capital suppliers and assisting companies in accessing private capital. They can also effectively address behavioral and organizational barriers. These schemes are particularly useful in supporting SMEs in realizing energy efficiency gains.

Tax Incentive in combination with Voluntary Agreements

This financial policy provides tax rebates or incentives to companies that replace old motors with more energy-efficient ones. It's often part of voluntary agreements in the industrial sector, aiming to reduce the financial burden of motor replacement and encourage the use of energy-efficient technologies. This policy addresses organizational barriers and often supports investments with a payback time of less than 3-4 years. Tax incentives are especially useful when addressing motor systems as they're widespread in manufacturing environments, but their applications vary widely. They also help alleviate the strain on public budgets.

Information Campaigns and Capacity Building

These non-financial policies target information, awareness, behavioral, and organizational barriers to the replacement of old motors and the optimization of motor systems. They aim to integrate energy efficiency considerations into core business strategies and processes. These campaigns can provide awareness-raising material, share best-practice case studies, give energy efficiency awards, provide technical guides and training, or offer tools to optimize motor systems and assess life-cycle costing.

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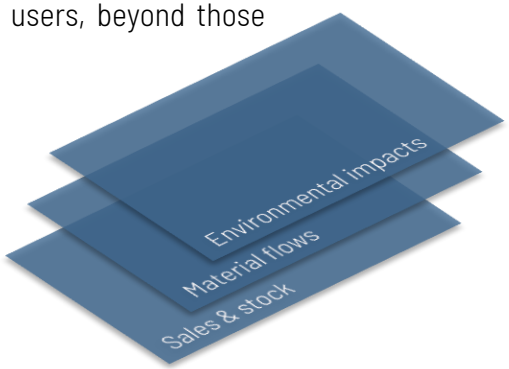
1.3 Underlying logic

The EU-M³ tool employs a layered approach where material and environmental impacts are deduced from motors on the market through a motor database. This database defines physical properties for motor variants (representative motors representing a large share of motors on the European market, such as energy consumption and material composition). The individual motor data is used to build up the stock model which allows for the assessment of the impact of policy interventions on the entire market over time.

The tool consists of three main components: a conventional stock modeling, a product database, and an environmental assessment which in the EU-MORE context consists of emission factors. These components work together to offer a comprehensive assessment of the motor market.

For its technical implementation, Excel was chosen due to its widespread recognition and usage across diverse industries, user-friendly interface, and sufficient functionality. This decision ensures that the EU-M³ can be accessed, understood, and potentially modified by a broad spectrum of users, beyond those with programming skills alone.

See 2.3 Policy impacts and monitoring for further information on how policy impacts are modelled.



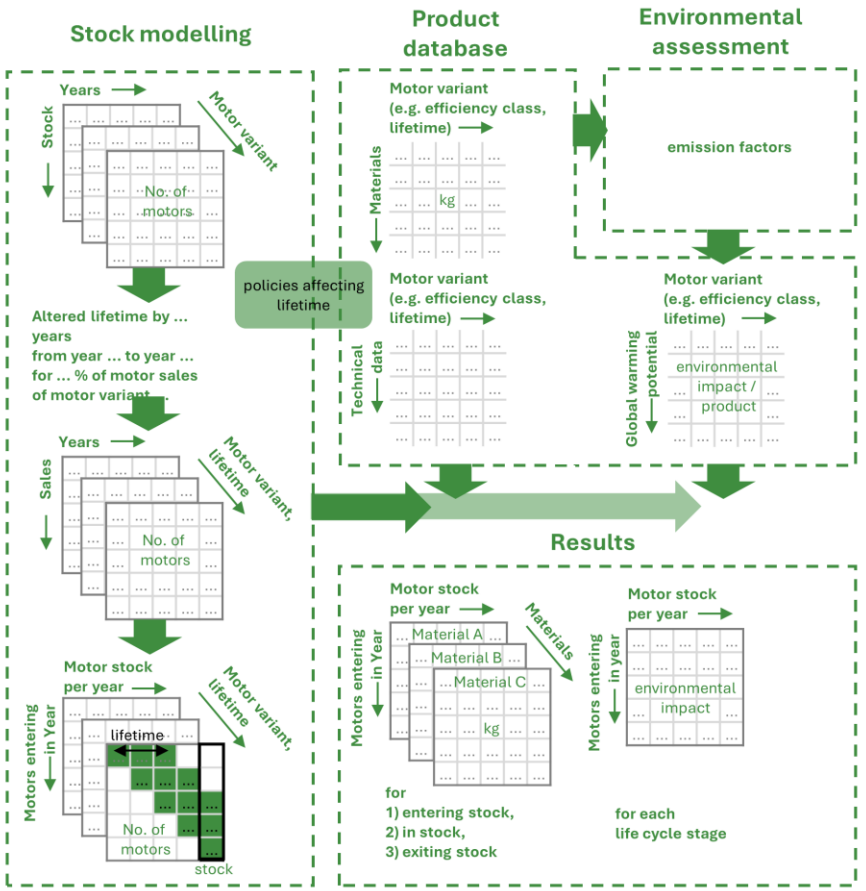


Figure: Schematic representation of the modeling logic

Link to D4.3 Policy impact analysis
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2. Exploration

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2.1 Getting started

Want to test out the tool?

The EU-M^3 has been implemented in Excel to ensure broad accessibility and usability and is available for download on the EU-MORE website, making it readily accessible to all interested parties. The goal is to make this tool as accessible and useful as possible to maximize its utility and impact.

To get started, follow the steps below

1. Open the EU-MORE project website at https://eu-more.eu/
2. Navigate to the Downloads section
3. To download an Excel version on your computer for offline usage:
   Look for D4.2 Stock-model to assess the policy impact of motor policies and select Download File

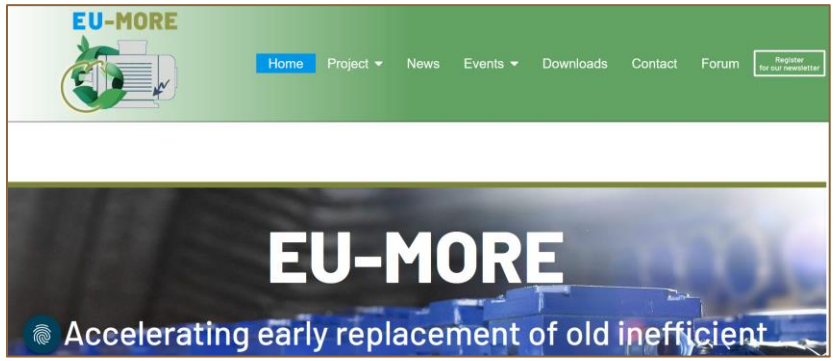

Figure: Landing page of the EU-MORE website

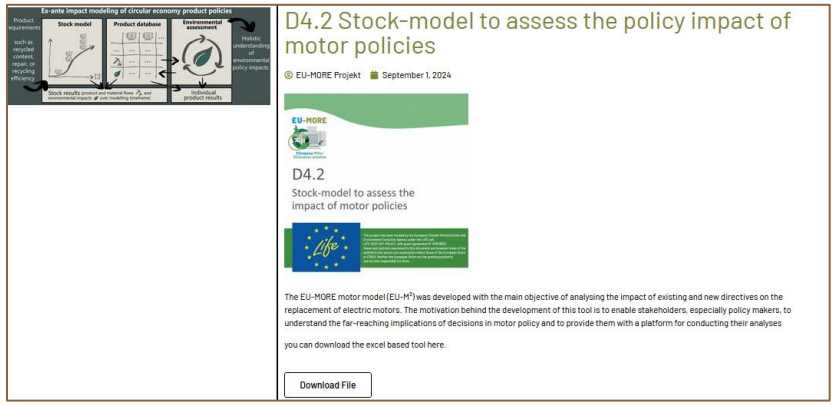

Figure: Download section of the EU-MORE website

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2.2 Using the tool

This user manual was created using the offline Excel file of the EU-MORE Motor Model (version 1.3). Click on the arrows in the navigation area to explore the tool.

Info tab

The info tab serves as the landing page of the motor model. It contains information on version history, authors and means of providing feedback.

It provides an overview of the different sheets, including information on the sheets which are hidden by default to keep the tool lean. For interested users on the functioning of the tool, the hidden sheets can be displayed.

Links are provided to documents or scientific articles which provide further information on the model or its underlying logic.

Finally, information is provided on the EU-MORE project.

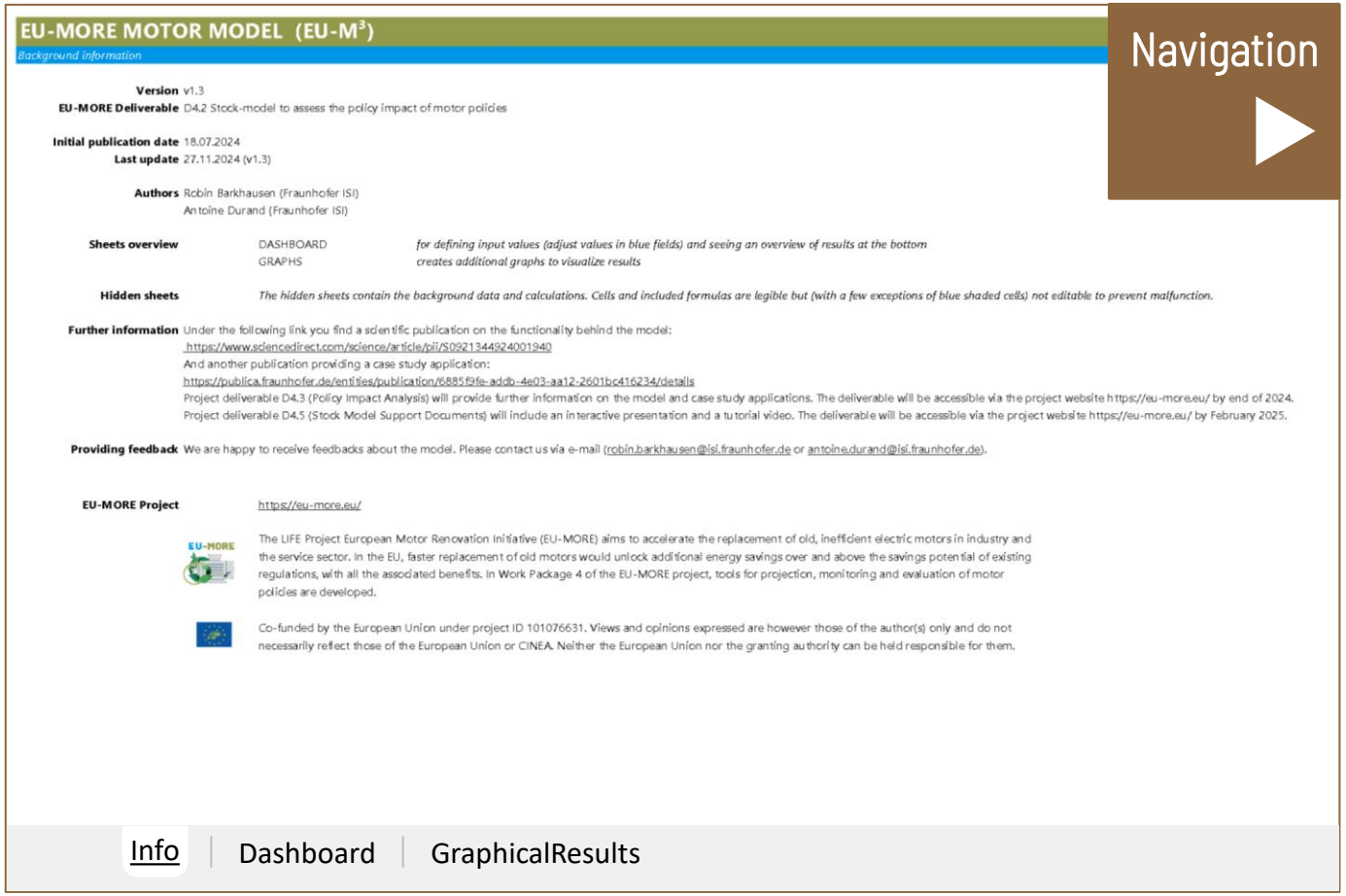

Figure: Click by click tour through the Excel file

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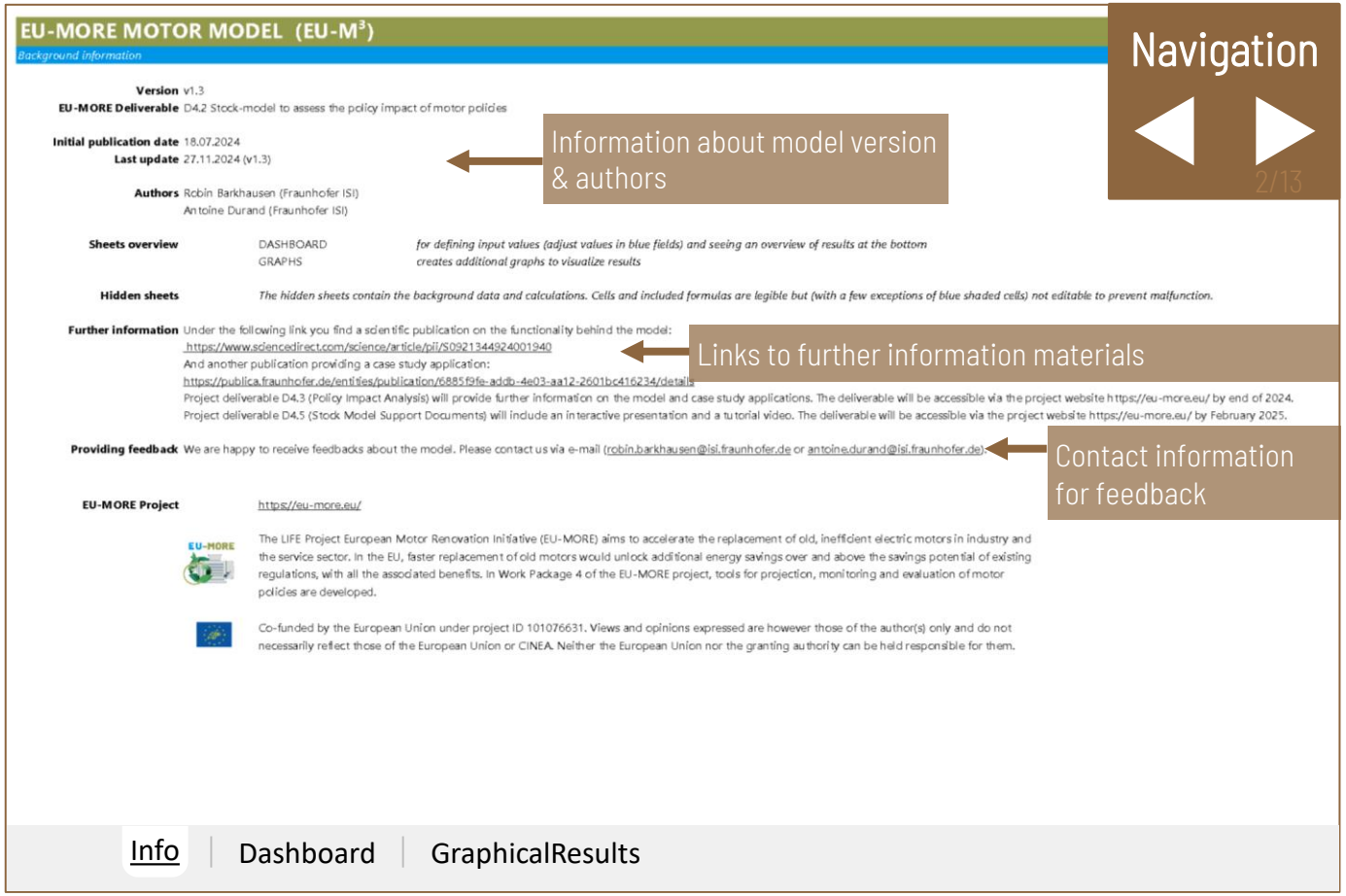

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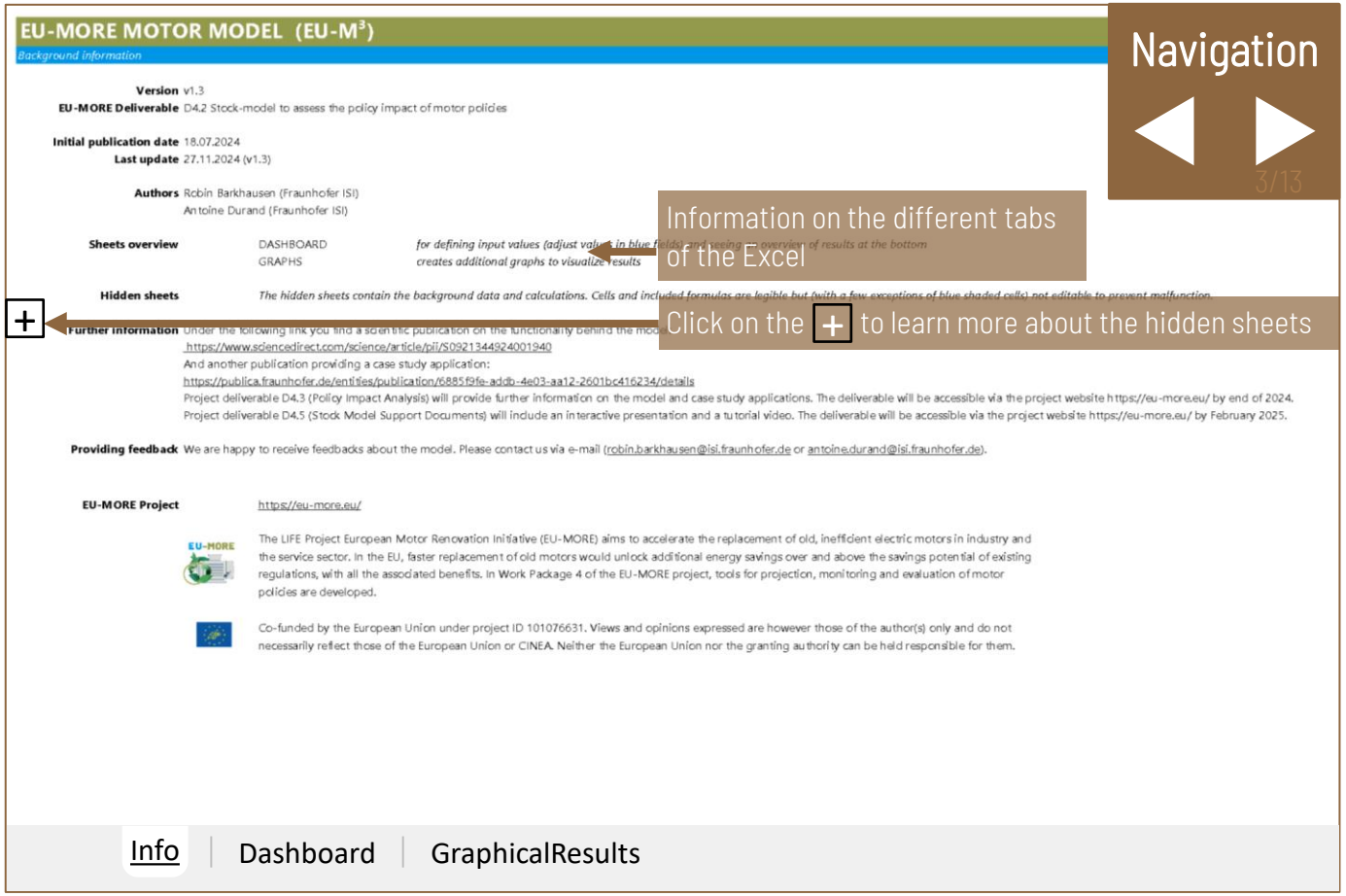

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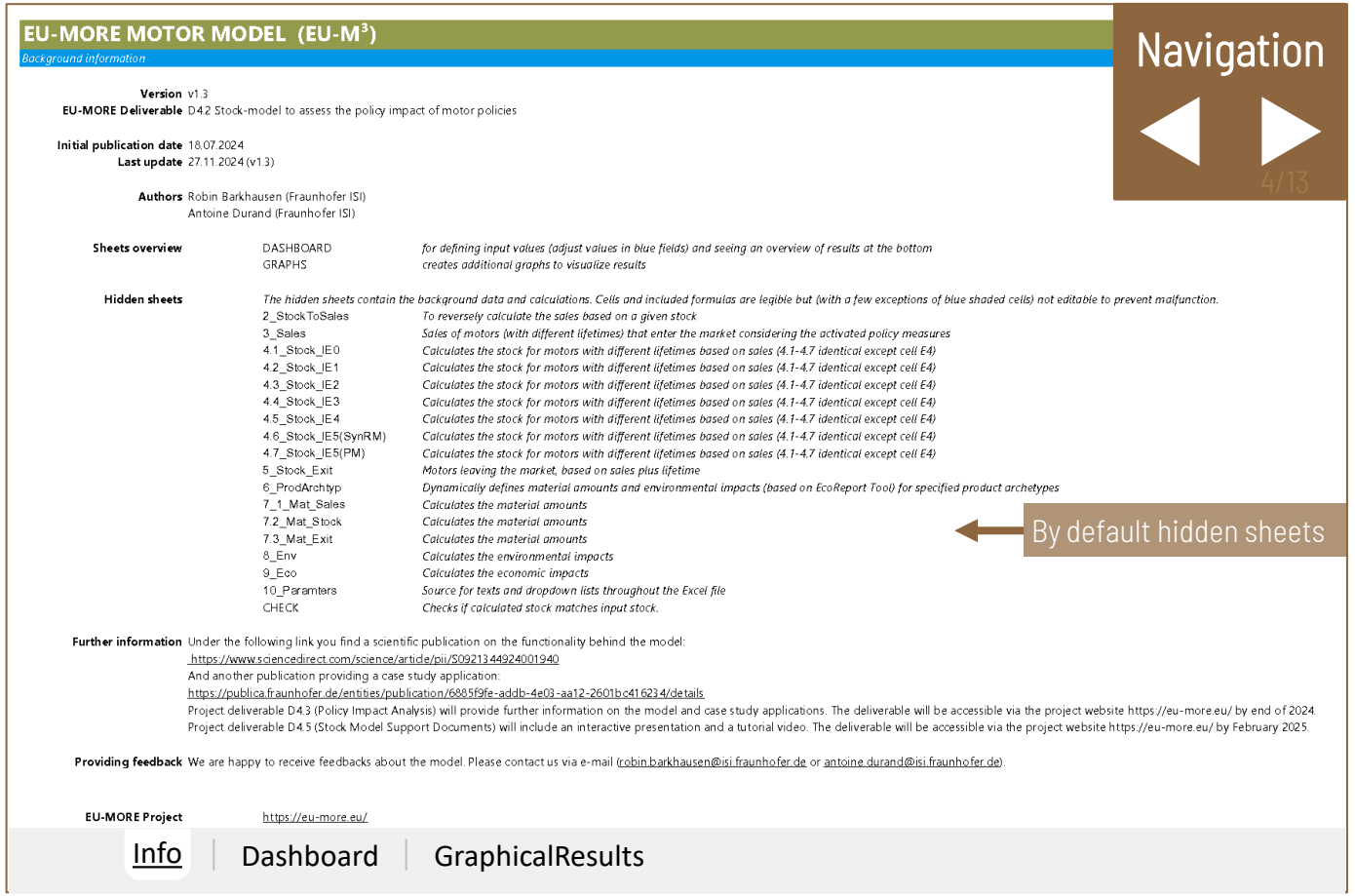

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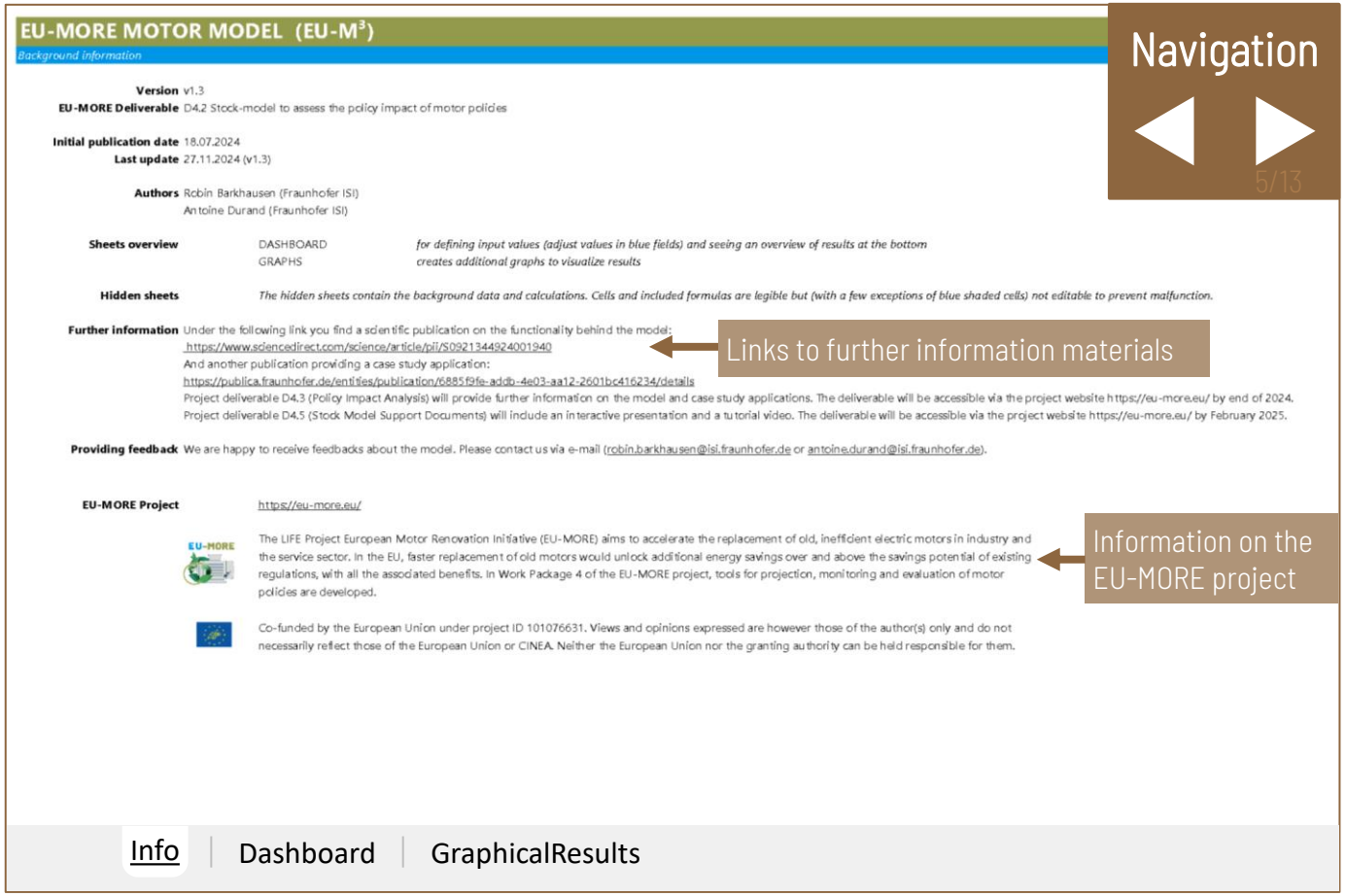

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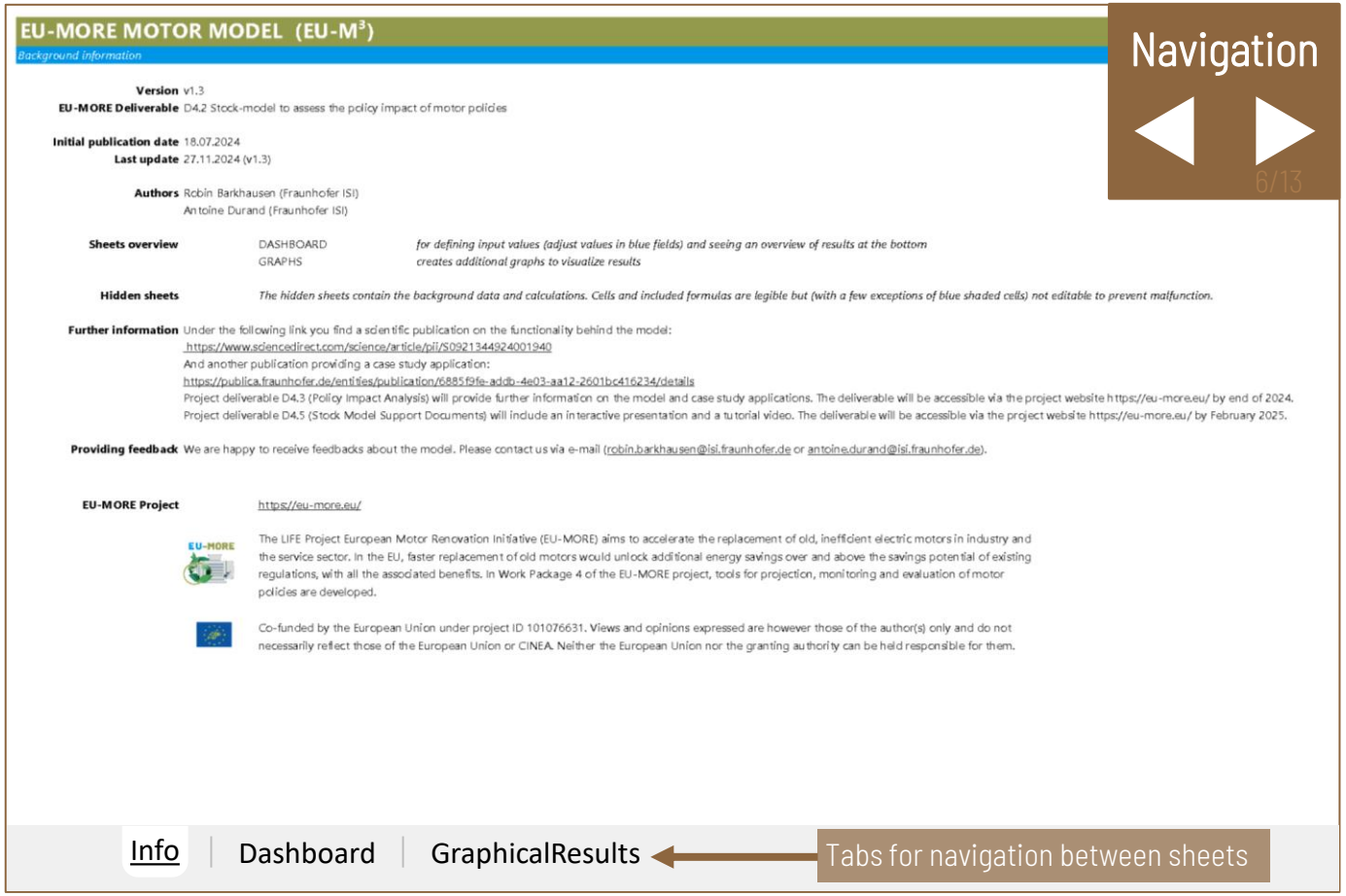
Navigation between sheets

To move to another sheet, click on one of the tabs at the bottom of the Excel.



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Dashboard

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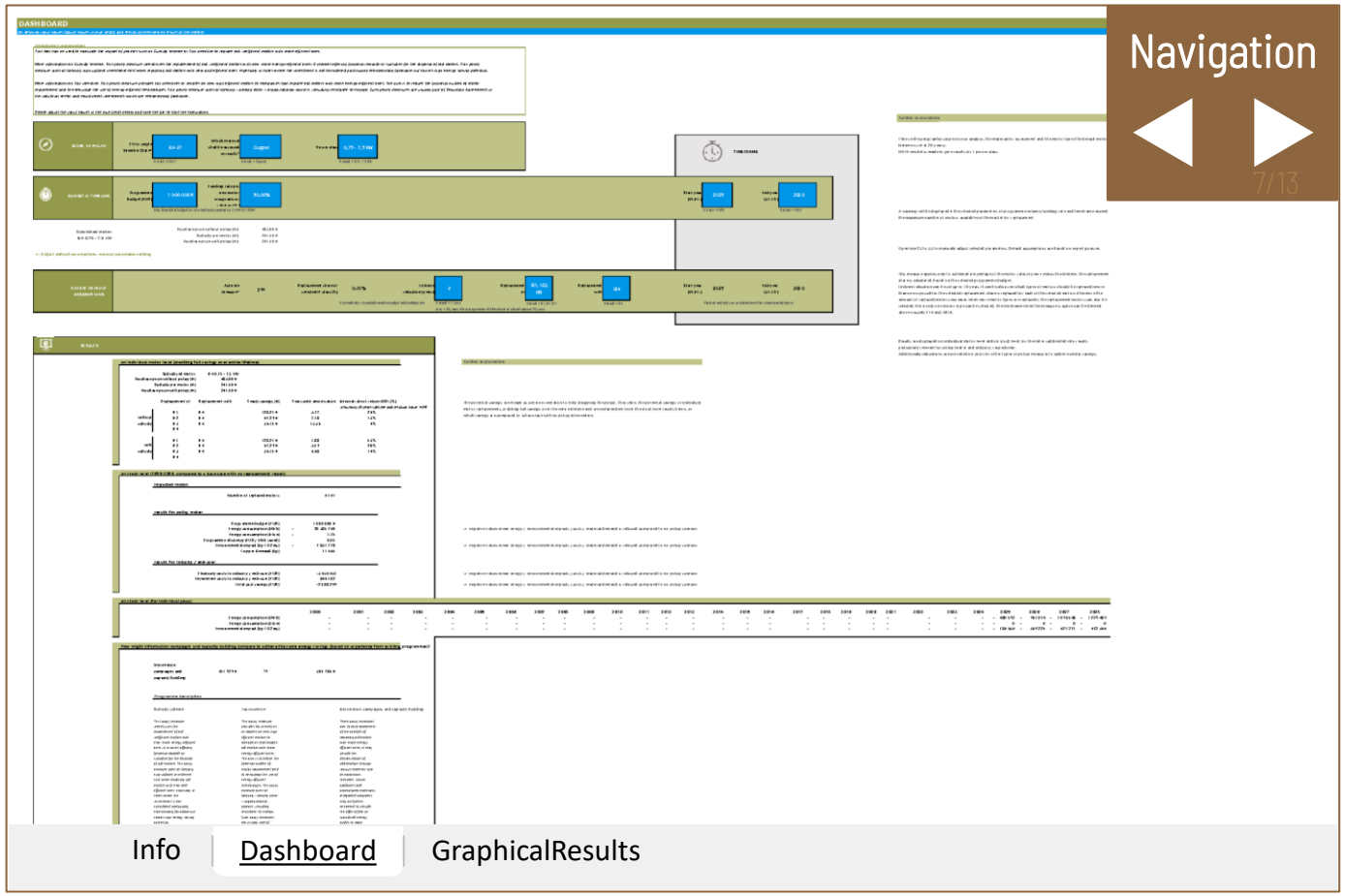

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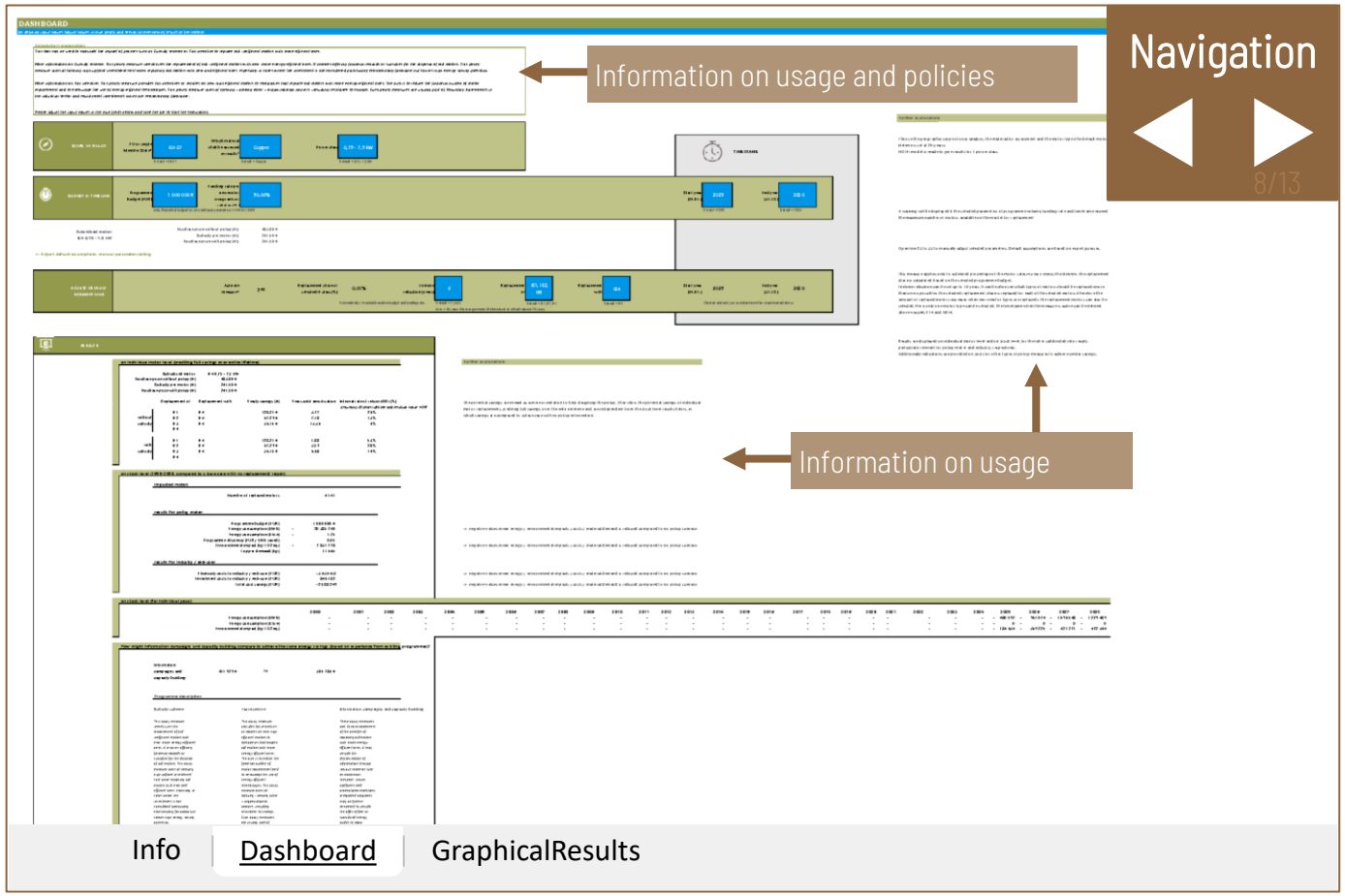

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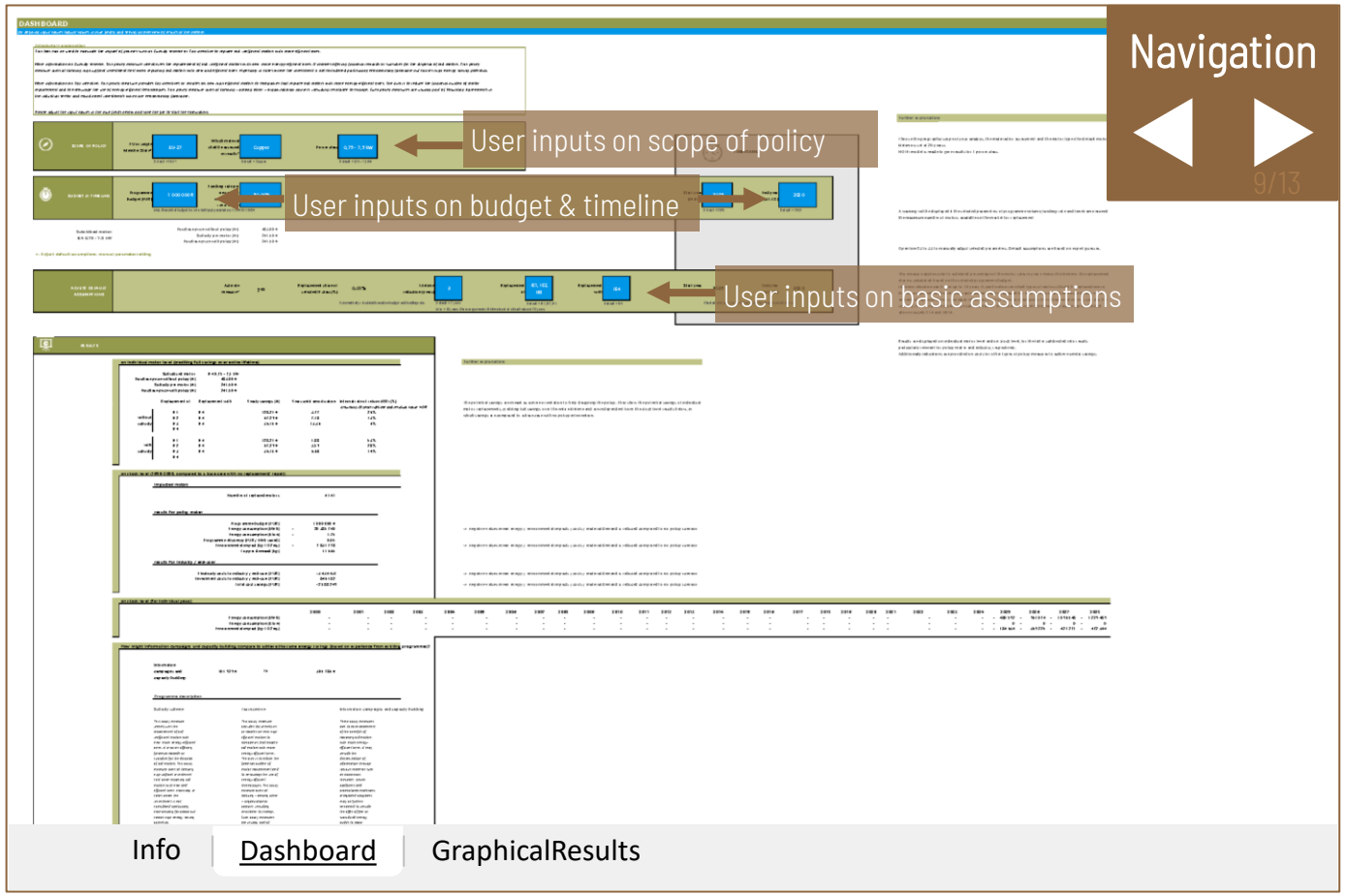
Dashboard

Blue shaded cells are the one where user information can be entered (all other cells are blocked). The following information can be entered:

Scope of policy
- Geographical scope (EU or Member State)
- Material to be assessed (only one at a time)
- Power class (only one power class can be selected)

Budget & timeline
- Programme budget
- Funding rate per new motor (via grants or rebates)
- Start & end year of policy

Basic assumptions (by default hidden but can be adjusted)
- Lifetime reduction (early replacement how many years earlier then technical lifetime)
- Replacement of which efficiency class (several can be selected)
- Replacement by which efficiency class (only one can be selected)



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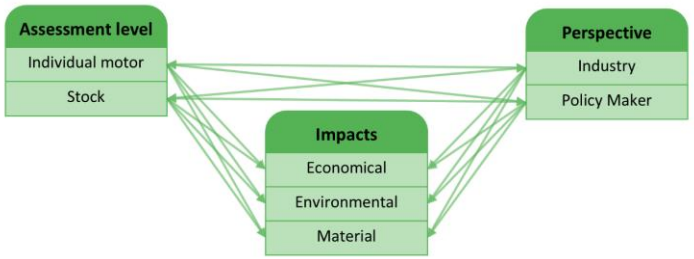
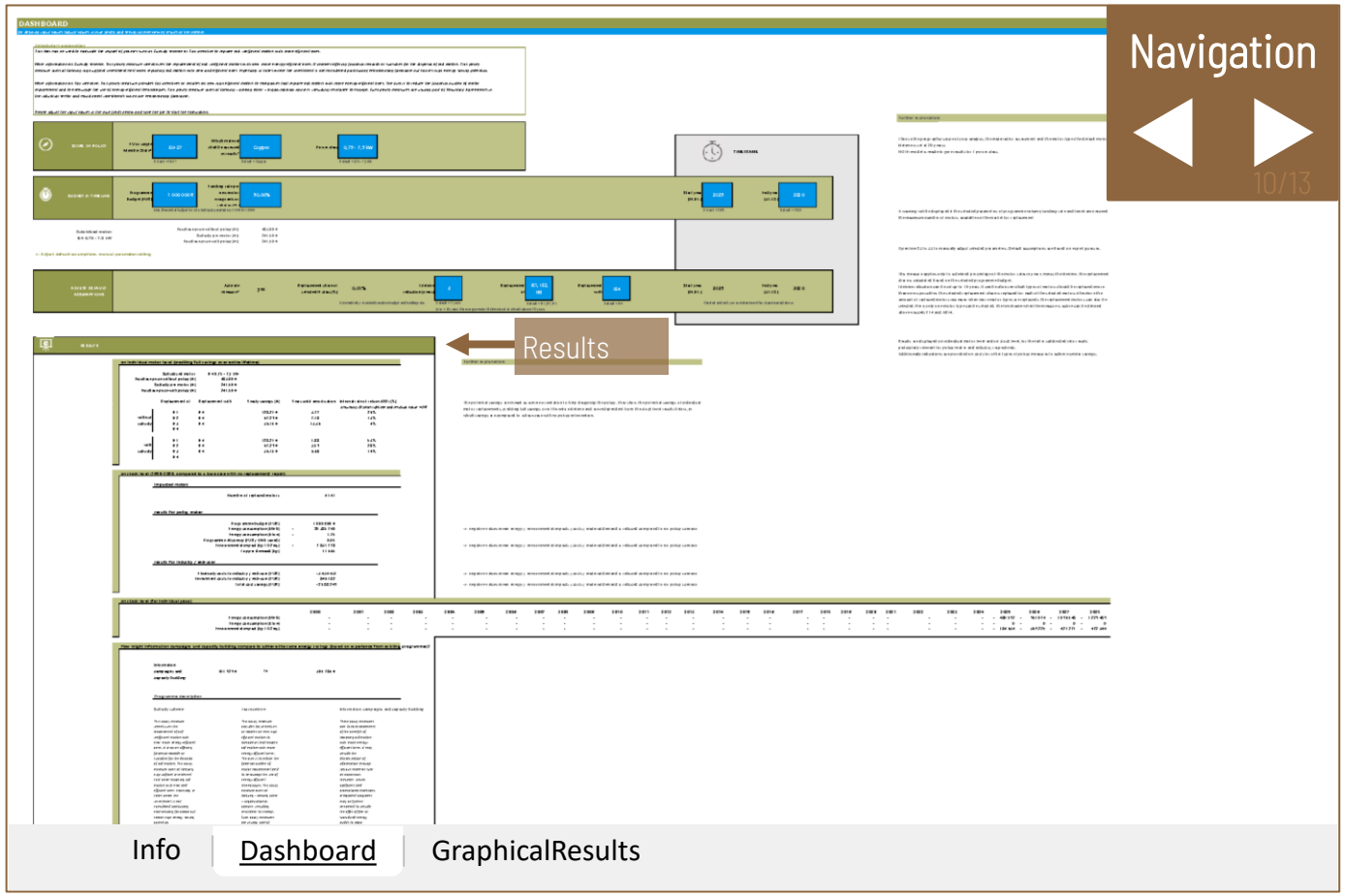
Automatic calculations are disabled in the Excel file to facilitate usage. After entering all information, the calculation is started by either saving the Excel file, clicking *Data* > *Refresh All* or use your keyboard shortcut to recalculate all formulas. Calculation might take up to 40 seconds depending on local computing capacity.

Results are then directly displayed at the bottom of the sheet.

They are grouped into those on motor and on stock level, from industry and policy maker perspective and for economical, environmental and material aspects. Further information on the results is provided in part 3. Application.





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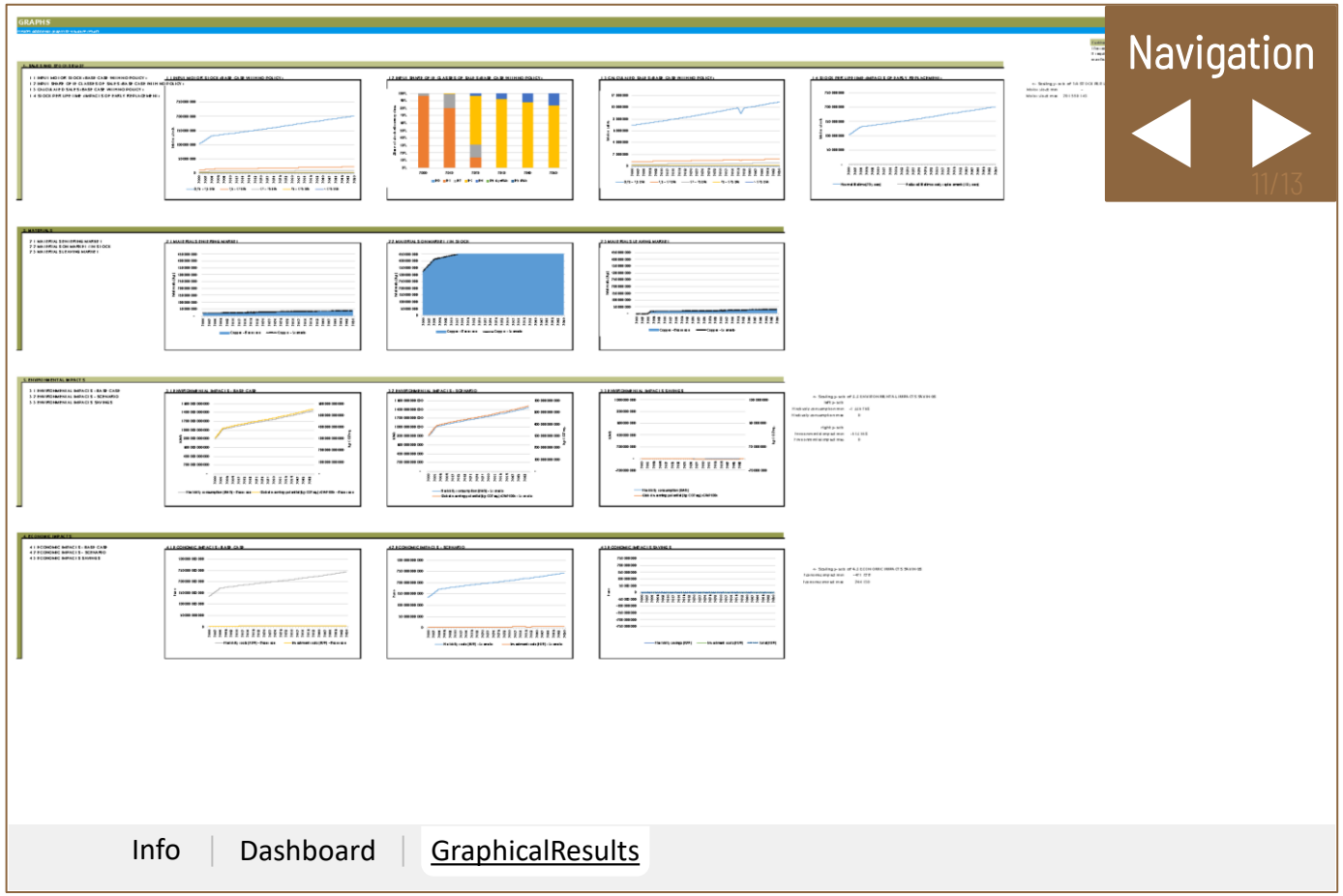
Graphical results

The Graphical results sheet extends the numerical values on the Dashboard.



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Graphical results

Graphs are divided into those related to sales and stock data, materials, environmental impact and economic impacts.
Due to the possibility to enter individual policy parameters, the scaling of the y-axis might have to be manually adjusted by clicking on the graph. For some of the graphs, the minimum and maximum values are automatically provided.

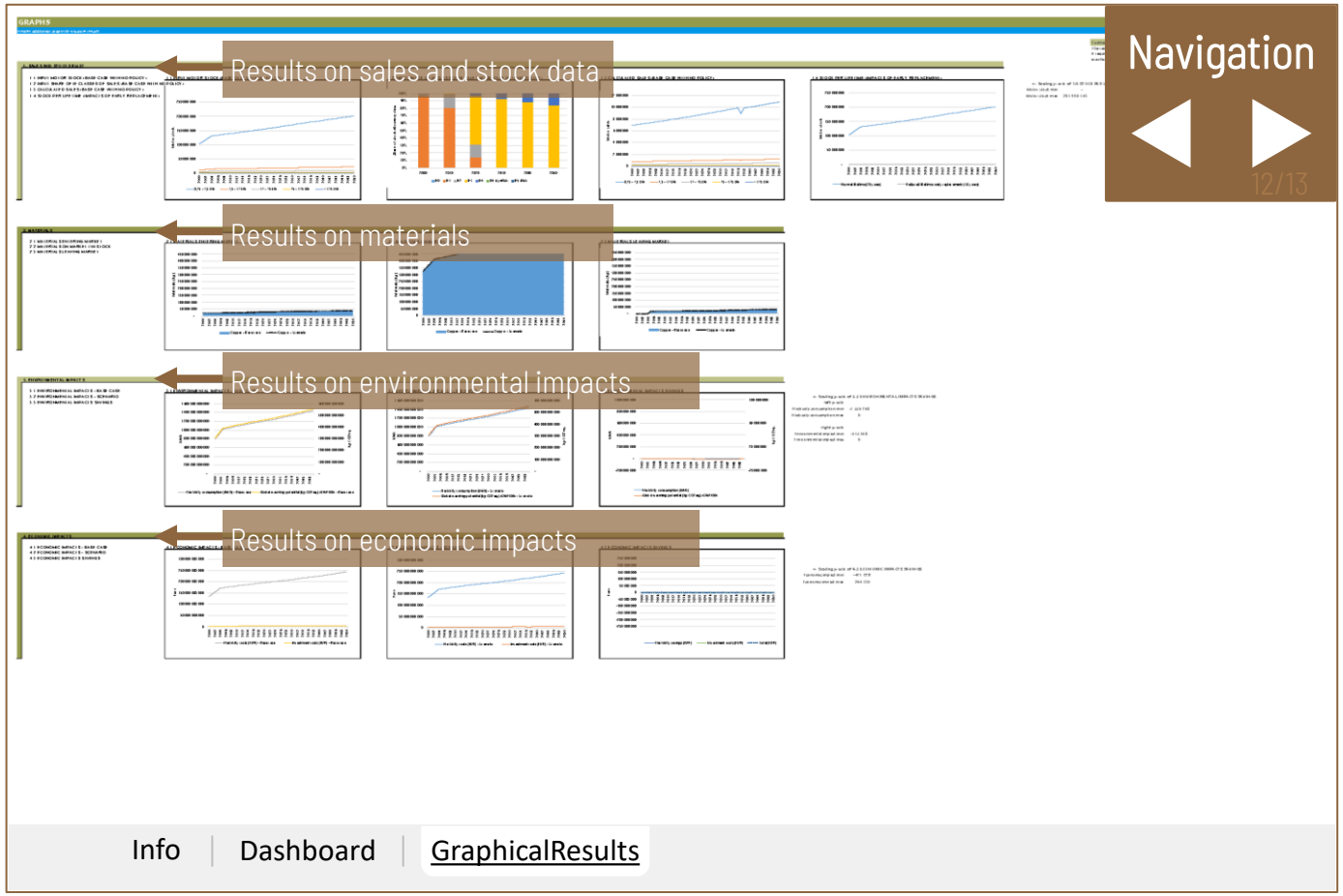

Figure: Click by click tour through the Excel file

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2.2 Using the tool

This user manual was created using the offline Excel file of the EU-MORE Motor Model (version 1.3). Click on the arrows in the navigation area to explore the tool.

Graphical results

Due to the possibility to enter individual policy parameters, the scaling of the y-axis might have to be manually adjusted by clicking on the graph. For some of the graphs, the minimum and maximum values are automatically provided.

Further information on the results is provided in part 3. Application.

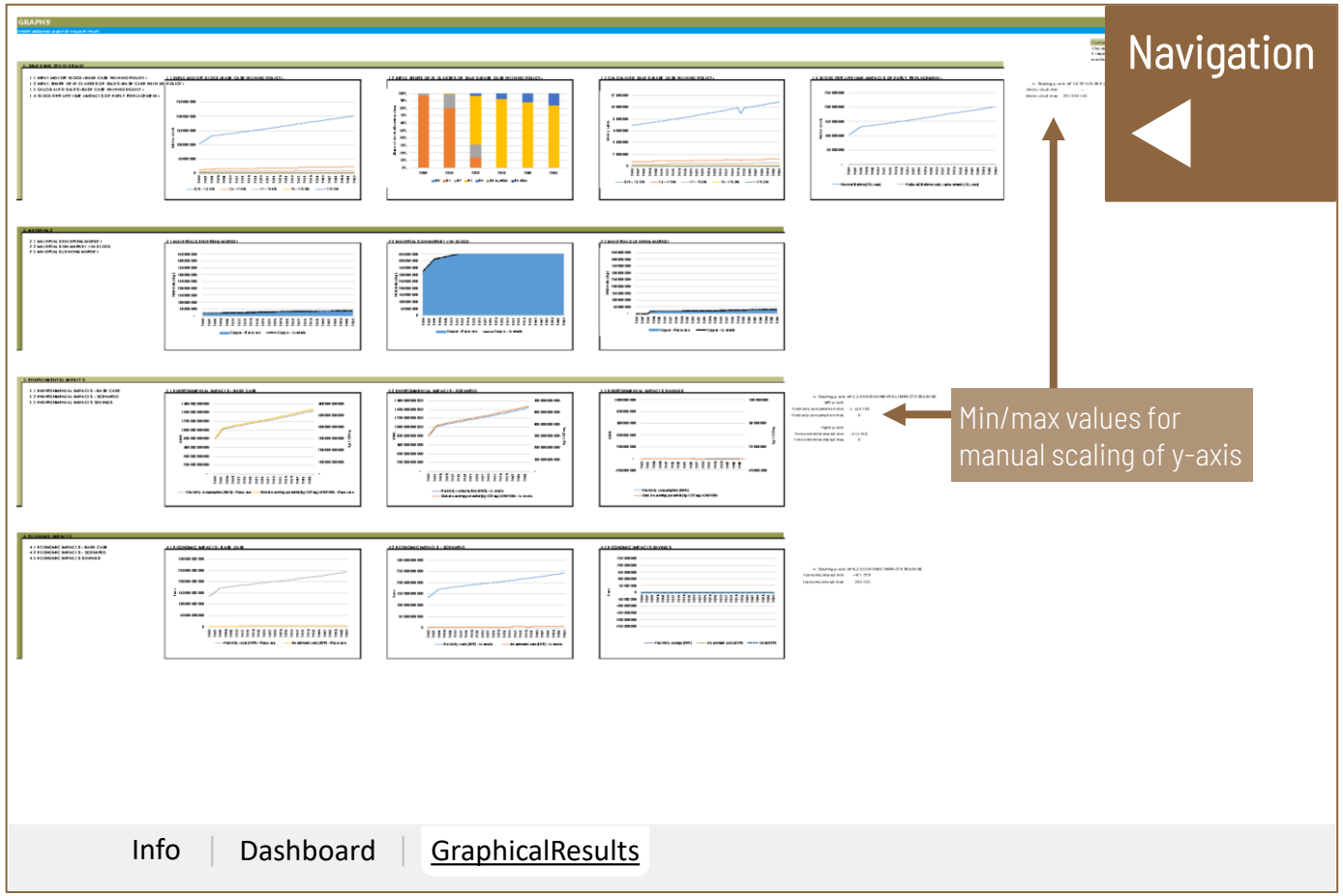

Figure: Click by click tour through the Excel file

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2.3 Policy impacts

Additional information on how savings are calculated

The motor model calculates its savings compared to a base case with no policy intervention. Therefore, instead of crediting the savings over the entire motor lifetime, savings are only counted for the years in which motors are removed from the market before their technical lifetime.

A two-year reduction in lifetime in the policy scenario means that motors are replaced two years later in the base case, and savings are correspondingly occurring for those two years. However, if the replacement is better than the market average at the end of the technical lifetime, then savings (difference between market average and new motor) are realized over the entire lifetime of the new motor. This is the case for energy consumption, CO_2 savings and energy costs.
An exception is the calculation of the IRR at individual motor level. This result is intended as a decision-making aid for the design of the policy. It therefore does not represent the officially accountable figures, but a hypothetical company perspective in which the investment is calculated over the entire lifetime of the motor.

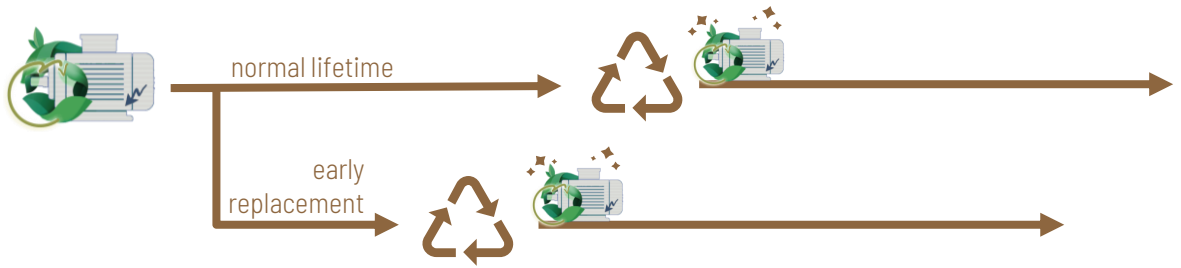
In its current form, the tool does not directly allow only savings beyond the minimum technical requirement to be taken into account (e.g. only the additional savings of an IE5 motor when an IE4 motor would be the required minimum). To nevertheless model such a scenario, the user must carry out two almost identical calculations, one with the old motor replaced with the minimum standard and one with the more efficient option. The difference between the two corresponds to the savings.

EU Energy Efficiency Directive 2023

Annex V COMMON METHODS AND PRINCIPLES FOR CALCULATING THE IMPACT OF ENERGY EFFICIENCY OBLIGATION SCHEMES OR OTHER POLICY MEASURES UNDER ARTICLES 8, 9 AND 10 AND ARTICLE 30(14)

1. Methods for calculating energy savings other than those arising from taxation measures for the purposes of Articles 8, 9 and 10 and Article 30(14).
Obligated, participating or entrusted parties, or implementing public authorities, may use the following methods for calculating energy savings: [...]
2. In determining the energy savings for an energy efficiency measure for the purposes of Articles 8, 9 and 10 and Article 30(14), the following principles apply: [...]

(m) for policies that accelerate the uptake of more efficient products and vehicles, except those newly implemented as from 1 January 2024 regarding the use of direct fossil fuel combustion, full credit may be claimed, provided that it is shown that such uptake takes place before the expiry of the average expected lifetime of the product or vehicle, or before the product or vehicle would usually be replaced, and the savings are claimed only for the period until the end of the average expected lifetime of the product or vehicle to be replaced; [...]



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EU-MORE

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3. Application

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3.1 Theoretical case study (1/2)

Introduction

In this hypothetical case study, we analyze a €2,000,000 financing program for a country similar to Belgium or the Netherlands in terms of electricity production. The program funds 50% of the cost of new motors, which aligns with schemes like the Portuguese Energy Efficiency Promotion Plan. This policy applies to motors with a power class between 37 - 75 kW and is active from 2025 to 2030. The program funds the early replacement of IE1 and IE2 motors with new IE4 motors, leading to energy savings.

It has to be noted that this example is theoretical - overall limitations of the case studies and the model overall are discussed in 4. Reflection.

The implementation steps are simple: open the Excel file, navigate from the *Info* tab to the *Dashboard* tab, and adjust the values in the blue fields. The user inputs are shown on the right.

Upon input, the user receives background data including the purchase price of an individual motor and the price with the activated policy.

As the user inputs values and runs the calculation, they are presented with background data. This includes the estimated cost of a single motor with the selected power class and efficiency level (in this scenario, an IE4 motor in the 37 to 75 kW range priced at €3,317.75), as well as the reduced cost under the policy (€1,658.88).

Link to D4.3 Policy impact analysis
Barkhausen, R.; Durand, A.; Ntaras, N.; Eichhammer, W. (2024)

User inputs

Geographical scope (EU or Member State)	EU average
One material for impact assessment	Copper
Power class of impacted motors	37 – 75 kW
Programme budget	€2,000,000
Funding rate per new motor	50%
Timeframe of policy (start and end year)	2025 – 2030
Lifetime reduction (how many years earlier do motors leave the market, respective to their assumed lifetime in the underlying motor market assessment)	2 years
Replacement of efficiency level (more than one class can be selected)	IE1, IE2
Replacement by efficiency level	IE4

Table: User input for theoretical case study

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3.1 Theoretical case study (2/2)

Results

After running the calculation in the Excel file, the key outcomes appear on the *Dashboard* tab. It displays individual motor and stock level results, industry and policy maker perspectives, and impacts on the economy, environment, and materials.

Economic Impacts

The calculations show that replacing an IE1 motor with an IE4 motor results in annual electricity savings of €673.36, with a payback period of 4.93 years and an internal rate of return (IRR) of 20%. The figures serve as a guideline for policy makers. Purchase prices with and without the subsidy are also provided.

Stock Level Results

The program would lead to 1,206 motors being replaced between 2025 and 2030, resulting in total energy savings of 34.21 GWh until 2050 (10.35 GWh saved while the policy is active). The program would result in €5,763,645 in electricity cost savings and trigger €1,673,217 in additional investments for purchasing IE4 motors.

Environmental Impacts

The total energy savings of 34.21 GWh translates to GHG savings of 12.14 thousand tonnes CO2eq.

Material Impacts

The early replacement with IE4 motors increases the demand for copper by 26.02 tonnes.

The model indicates a maximum theoretical budget of €132,784,586, which would result in maximum energy savings of 2,271.36 GWh and environmental savings of 872.61 thousand tonnes kg CO2eq.

Link to D4.3 Policy impact analysis
Barkhausen, R.; Durand, A.; Ntaras, N.; Eichhammer, W. (2024)

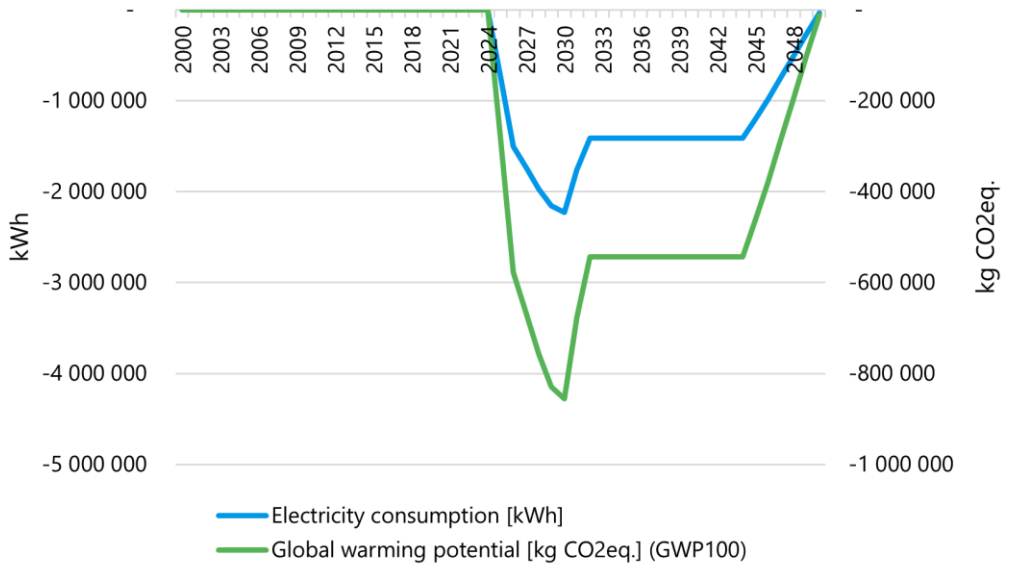

Figure: Example graphical results: environmental impact savings by early motor replacement

Click here for further information on the curve and underlying logic

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3.1 Theoretical case study (additional information)

Further explanation on results graph

The graph on the right shows the modelling logic for a replacement of IE2 motors with IE4 motors (replacements of IE3 motors follows the same logic). Additionally, it shows how the curve of energy savings from the graph in page 29 can be explained.

- 2025 to 2030, the policy is active and replacements of IE2 motos with higher efficiency IE4 motors generate savings.
- From 2027, replacements are still occurring, but IE2 motors that have not been replaced (replacement share is lower than 100%) are replaced at the end of their technical lifetime with market average, leading to a flattening of the curve.
- 2031 to 2032, a reduction in savings occurs as no additional replacements occur and unaffected motors keep getting replaced after their technical lifetime.
- 2033 to 2044, replaced motors keep generating savings, creating a balance with continued savings.
- 2045-2050, as replaced motors exit the market and are replaced with market average, energy consumption realigns with the base case.

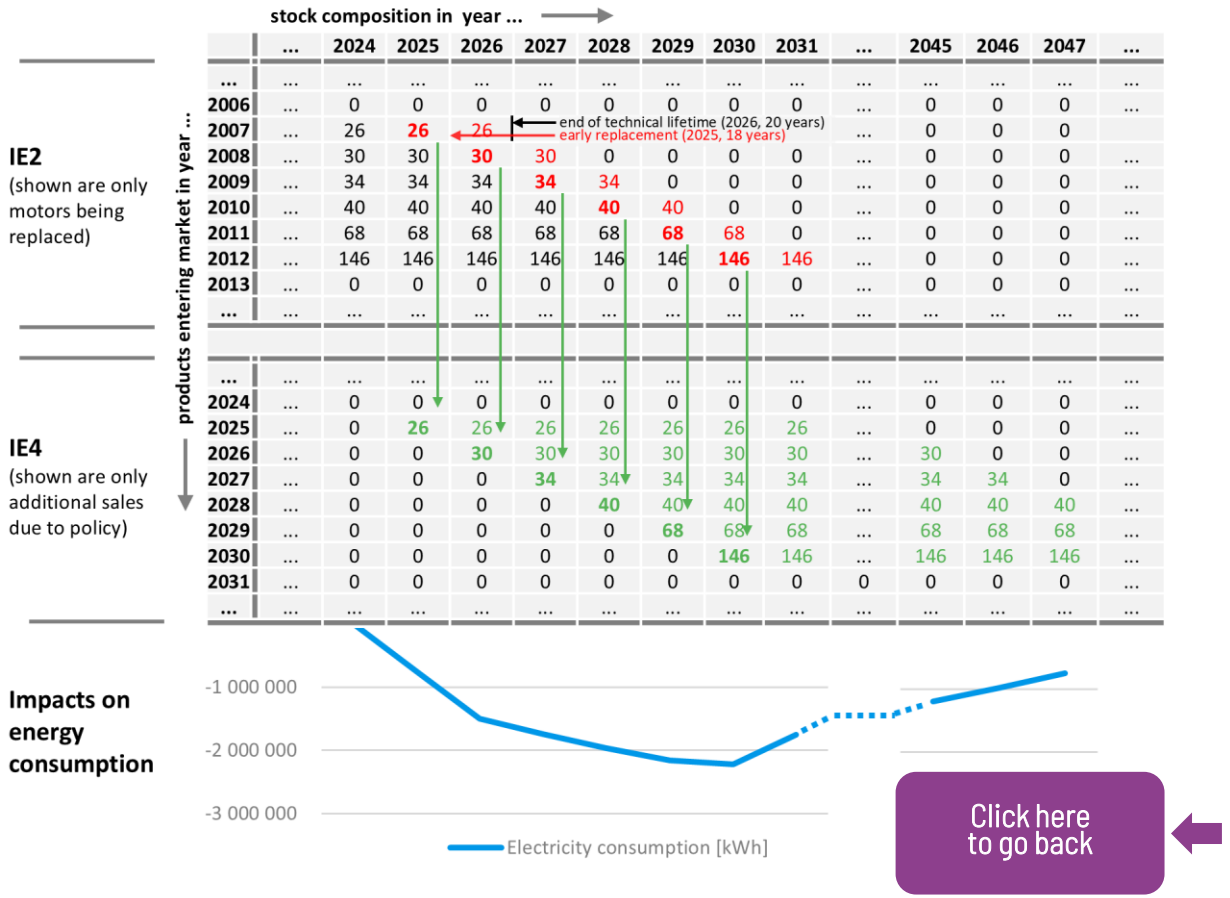

Figure: Explanatory representation of sales, stocks, and savings (replacements of IE3 motors are not shown but follow the same logic)

Link to D4.3 Policy impact analysis
Barkhausen, R.; Durand, A.; Ntaras, N.; Eichhammer, W. (2024)

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3.2 Practical example 1 (1/2)

Introduction

Chosen for assessment is the Portuguese Energy Efficiency Promotion Plan (PPEC) as a representative of a subsidy scheme.

The 6th edition of the program (2017-2018) incentivized High Efficiency Motor (IE3 or IE4) installations of 0.75 kW to 400 kW in manufacturing, agriculture, and fisheries, replacing low-efficiency motors. A 51.1% financial incentive was given, totaling 896,767€. A quick motor usage assessment ensured proper replacement motor dimensioning.

Modeling this policy required several assumptions due to limited data. The market analysis excluded IE0 motors, so IE1 motors were assumed to be replaced, a conservative assumption considering IE0's lower energy efficiency. To maintain performance gradient, replacement motors were assumed to be the more efficient IE4. A lifetime reduction of 5 years was assumed for IE1 motors. The power range encompassed all power classes in our model. Due to data scarcity, the 37-75 kW range was chosen to represent average power consumption and investment costs.

The table on the right contains all input data. The assumptions underline the importance of available data and the difficulty in accurately representing nuances such as sector exclusion, installation cost coverage, or motor dimensioning.

User inputs

Geographical scope (EU or Member State)	Portugal
One material for impact assessment	Copper
Power class of impacted motors	37 – 75 kW
Programme budget	€896,767
Funding rate per new motor	51.10%
Timeframe of policy (start and end year)	2017 – 2018
Lifetime reduction (how many years earlier do motors leave the market, respective to their assumed lifetime in the underlying motor market assessment)	5 years
Replacement of efficiency level (more than one class can be selected)	IE1
Replacement by efficiency level	IE4

Table: User input for practical example 1

Link to D2.2 Review of past and existing policies for the acceleration of electric motor renovation
Faassen, E.; Eichhammer, W.; Sangiorgio, I. (2024)

Link to D4.3 Policy impact analysis
Barkhausen, R.; Durand, A.; Ntaras, N.; Eichhammer, W. (2024)

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3.2 Practical example 1 (2/2)

Results

The €896,767 budget and 51.10% funding, together with the previously mentioned assumptions, resulted in 529 motor replacements, 26% higher than the figures from the actual program of 420. This will likely be due to the fact that it is not clear which motor sizes have been exchanged under the scheme, nor their purchase price and how strongly its average diverges from the numbers of the motor market study underlying the model (in this case 3 318€ for an average IE4 motor in the range 37 – 75 kW). The replaced IE1 motors represent 4.78% of all replaceable IE1 motors from 2017-2018.

According to the model the 529 IE1 motors in the power range of 37 – 75 kW that have been replaced represent 4.78% of the overall replaceable IE1 37 – 75 kW motors from 2017 to 2018 (based on the underlying inventory data and the country scaling). Here it has to be noted that for the overall number of motors the model uses a country scaling reducing the EU numbers based on Member State gross electricity. While this can serve as an approximation for industry size and correspondingly number of motors, it might be over- or understimating the factual numbers.

Exchanging an IE1 with an IE4 motor yields a 16% Internal Rate of Return and 5.93 years until break-even. This number seems adequate for subsidy schemes (which should be preferably support investments with a payback time of more than 3-4 years.

The program triggered motor investments of €249,147, resulting in €3,131,171 energy cost savings (or an overall net benefit of €2,882,024) and reducing energy consumption by 22.36 GWh, lower than the reported 115 GWh under the official program. Missing data and necessary assumptions likely caused this discrepancy.

The program led to 8.59 thousand tonnes of CO2eq savings, less than the reported 43 thousand tonnes. The cost-effectiveness ratio is calculated to €0.04/kWh saved, higher than the €0.008/kWh reported by the scheme.

Material savings included an additional 4.91 tonnes of Copper for IE4 motors. This impact is measured over the modelling timeframe until 2050 and for the entire Portuguese market.

The results highlight significant savings but also discrepancies with reported figures due to data limitations and modeling simplifications. A more detailed data set might bridge these gaps. This doesn't undermine the model or program's value but highlights the inherent complexities and uncertainties in projecting and assessing the impacts of policy measures.

Link to D4.3 Policy impact analysis
Barkhausen, R.; Durand, A.; Ntaras, N.; Eichhammer, W. (2024)

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3.3 Practical example 2 (1/2)

Introduction

Chosen for assessment is the Dutch Energy Investment Allowance as a representative of a tax incentive.

Companies participating in the program stand to benefit from a funding range that falls between a minimum of €2,500 and a maximum of €136,000,000. They are given the opportunity to deduct 45.5% of their investment costs from their taxable profit. Under the assumption of enough taxable profit and estimating a corporate tax rate that sits around 20%, this translates into 20% of 45.5% tax savings for the company, equating a funding rate of 9.1% per motor.

There is a variety of electric motors that qualify for this funding, one notable category being those with a nominal power of less than 75 kW. Regarding the program budget, in the year 2023 it is reported at €249,000,000. However, it remains unclear what portion of this budget will be specifically allocated for motor replacements.

Due to a lack of comprehensive data, an assumption is made that a 1% share of this budget will be earmarked for the power class of 0.75 – 7.5 kW. It's important to note that this power class represents only a fraction of the overall motor market. The already stated and further assumptions are reported in the table on the right.

User inputs

Geographical scope (EU or Member State)	Netherlands
One material for impact assessment	Copper
Power class of impacted motors	0.75 – 7.5 kW
Programme budget	€2,490,000
Funding rate per new motor	9.10%
Timeframe of policy (start and end year)	2023
Lifetime reduction (how many years earlier do motors leave the market, respective to their assumed lifetime in the underlying motor market assessment)	2 years
Replacement of efficiency level (more than one class can be selected)	IE1
Replacement by efficiency level	IE4

Table: User input for practical example 2

Link to D2.2 Review of past and existing policies for the acceleration of electric motor renovation
Faassen, E.; Eichhammer, W.; Sangiorgio, I. (2024)

Link to D4.3 Policy impact analysis
Barkhausen, R.; Durand, A.; Ntaras, N.; Eichhammer, W. (2024)

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3.3 Practical example 2 (2/2)

Results

With a budget of €2,490,000, the model projects energy savings of 337.77 GWh and environmental savings of 129.77 thousand tonnes CO_{2eq}. This equates to programme efficiency of €0.01/kWh saved, which can be converted to €0.019/kg CO_{2eq} saved. This figure is comparable to the €0.014/kg CO2eq saved reported by the Dutch scheme. Additionally, the model estimates an extra demand of 91.58 tonnes of Copper (without considering recycling). All these numbers are calculated for the modelling timeframe until 2050.

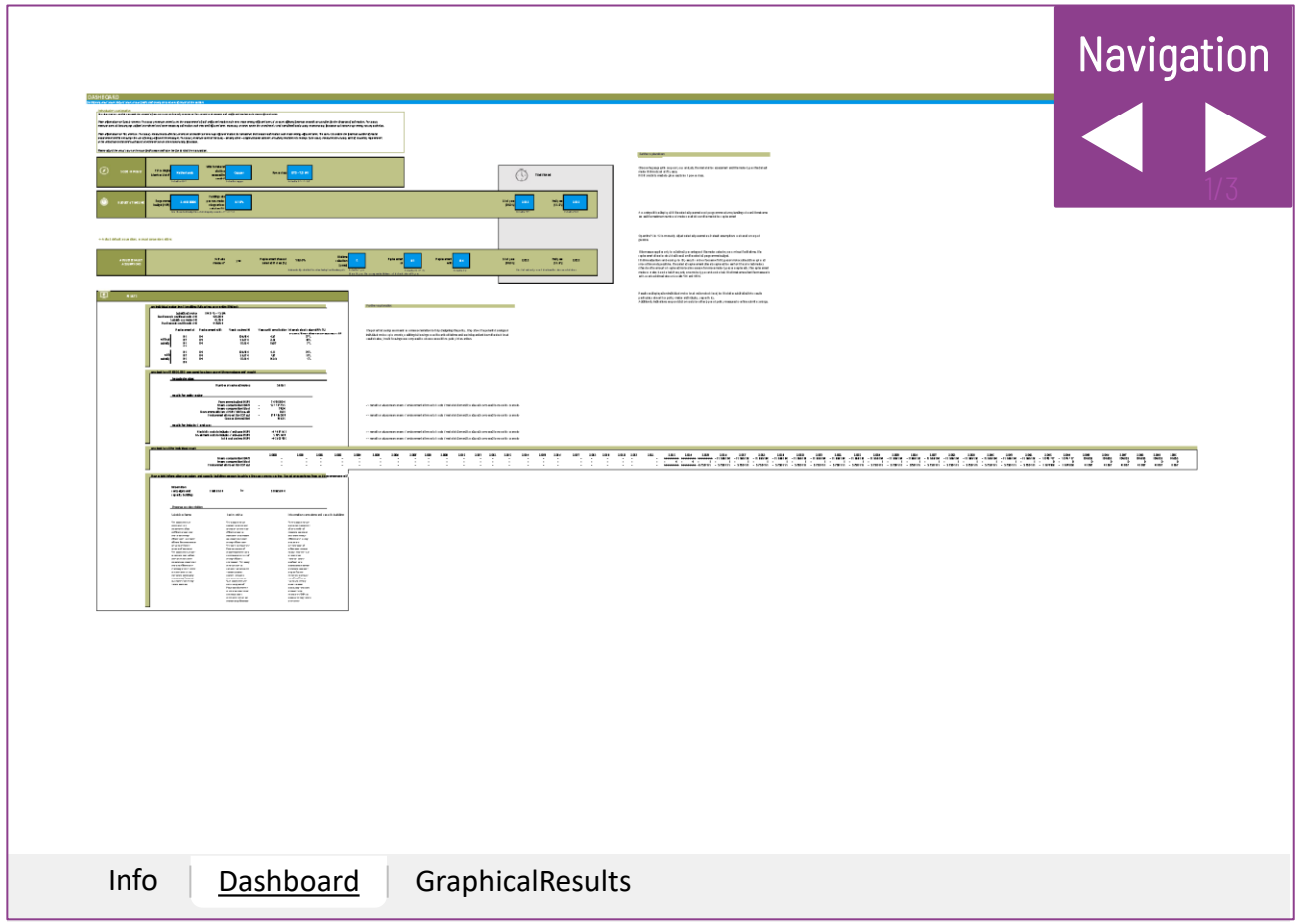

Figure: Click by click tour through the results in the Excel file

Link to D4.3 Policy impact analysis
Barkhausen, R.; Durand, A.; Ntaras, N.; Eichhammer, W. (2024)

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3.3 Practical example 2 (2/2)

Results

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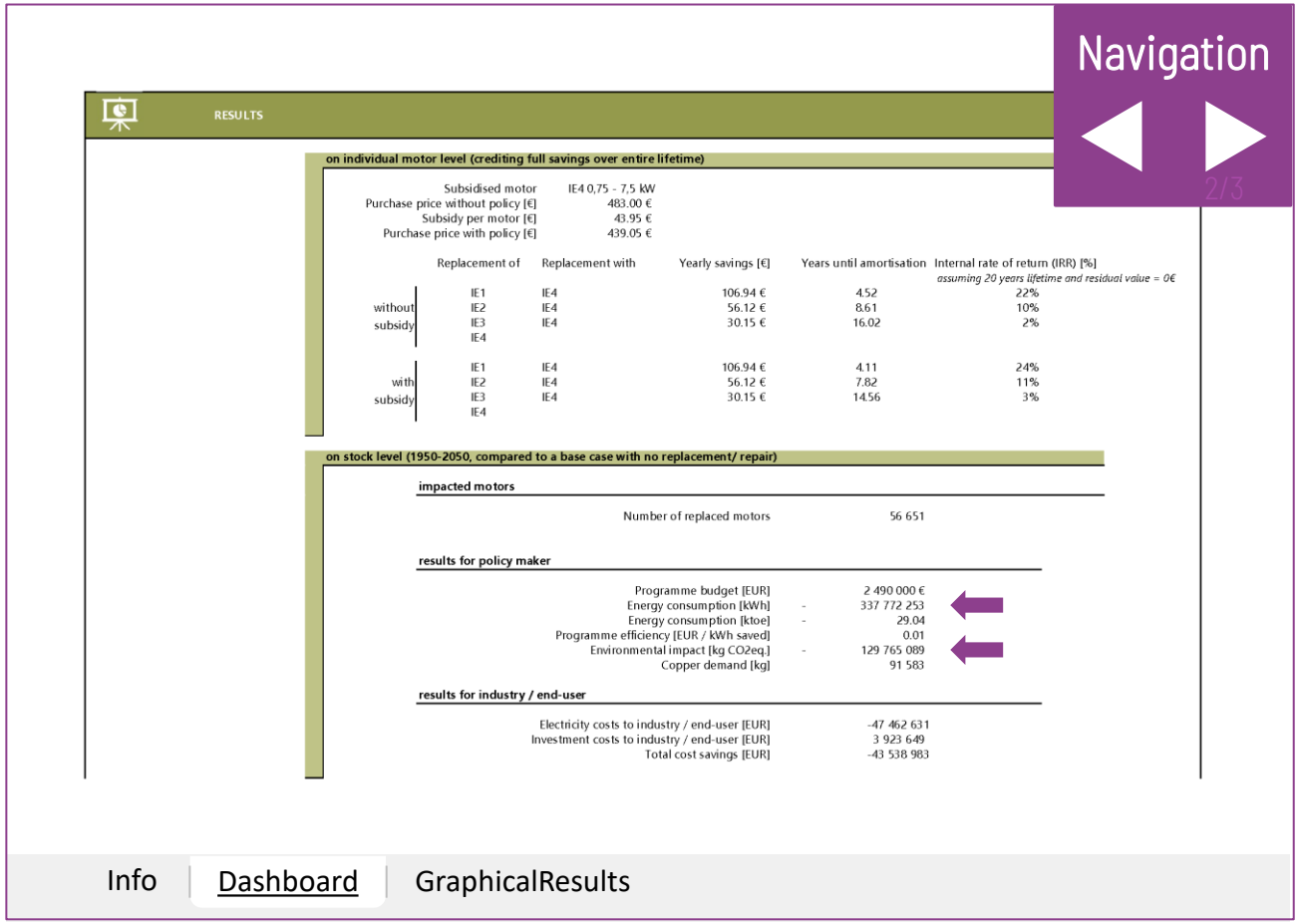

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Barkhausen, R.; Durand, A.; Ntaras, N.; Eichhammer, W. (2024)

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3.3 Practical example 2 (2/2)

Results

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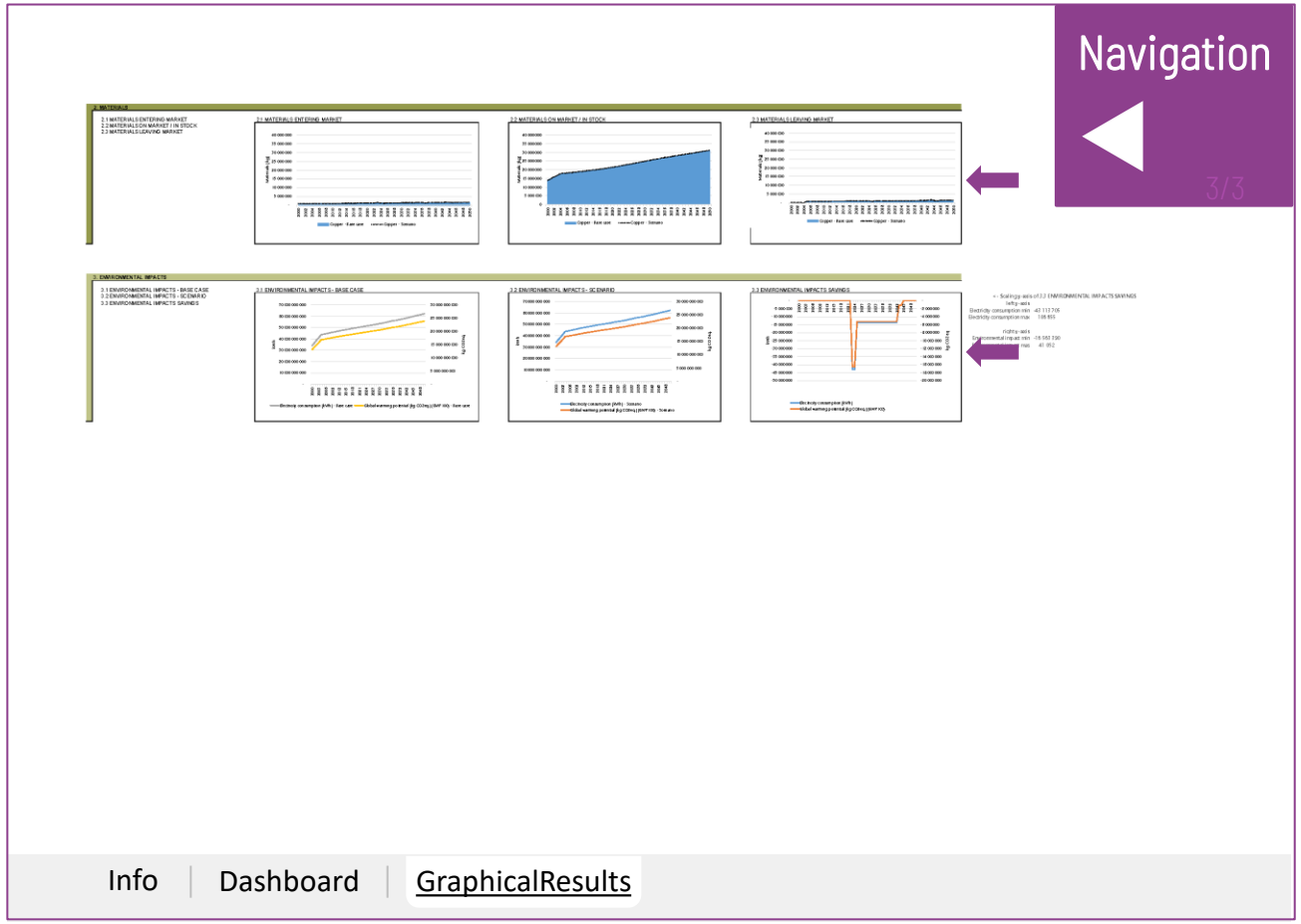

Figure: Click by click tour through the results in the Excel file

Link to D4.3 Policy impact analysis
Barkhausen, R.; Durand, A.; Ntaras, N.; Eichhammer, W. (2024)

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4. Reflection

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4. Reflection

4.1 Prerequisites

The reliability of the results from the EU-M^3 model is highly dependent on the quality of user inputs and background data. Underlying data sources derive from previous tasks of the EU-MORE project and from the literature (see D4.3 Table 1) , but their reliability varies.

Some simplifications in the background data are necessary, such as setting a static lifetime (in this case 20 years) for all motors to match the actual motor data. In reality, the motor lifetime follows a distribution function, which can result in much longer lifespan. The current model design works with a fixed lifetime representing the average lifetime of motors on the market.

4.2 Limitations

The model has limitations in terms of its accuracy and complexity. It can only apply the policy to one selected power class per calculation and requires significant computing time due to the high number of background calculation steps.

The calculated cost efficiencies are mostly in order with those reported in the practical policy examples, like the Portugal Energy Efficiency Promotion Plan (PPEC) and the ProkiloWatt programme in Switzerland.

However, the model's estimates should be interpreted with caution due to necessary simplifications and assumptions inherent in the model. For example, the country scaling is based on gross electricity production as a rough proxy for industry size with clear limitations in accuracy.

4.3 Future

The EU-M^3 model provides useful insights but its results depend heavily on the quality of inputs and underlying data. While it offers a detailed view of market dynamics, its estimates should be interpreted with caution due to the necessary simplifications and assumptions inherent in the model.

In the future, it would be beneficial to improve data inputs and refine assumptions to enhance the accuracy of the model. For instance, providing more accurate data on motor lifetimes or refining the country scaling method could result in more precise estimates.

Link to D4.3 Policy impact analysis
Barkhausen, R.; Durand, A.; Ntaras, N.; Eichhammer, W. (2024)

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D4.5

Stock model support documents Interactive presentation

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The end